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ADULTERATION OF INSECT POWDER WITH POWDERED DAISY FLOWERS (CHRYSANTHEMUM LEUCANTHEMUM L.).

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ADULTERATION OF INSECT POWDER.

Almost from the time that it first appeared as an article of commerce, insect powder has been subjected to adulteration with a great variety of substances. Flowers of other plants of the family Compositæ naturally suggested themselves for this purpose, particularly those of the genus Chrysanthemum, to which the three species of genuine insect flowers[1] belong. Of all the species of Chrysanthemum, *C. leucanthemum* probably has been one of those most often utilized for the sophistication of insect powder, and in the course of the examination of commercial insect powders for the Insecticide and Fungicide Board, its presence has been frequently detected. This plant, popularly known as "oxeye daisy," "field daisy," "white weed," and "marguerite," is a common weed in many parts of the United States, and also grows wild in those regions in Europe where the Dalmatian insect flowers (*C. cinerariæfolium*) grow. Its cheapness and ready availability have favored its use as an adulterant.

The flowers have been the only part of the plant used for this purpose. These flowers, a regular article of commerce with the collectors of crude drugs in certain parts of the southern United States, are gathered by people living in the mountainous districts, who dry them, and then deliver them to country storekeepers in exchange for merchandise. When the storekeeper has accumulated a sufficient stock of "medicinal" roots, herbs, barks, flowers, etc., he takes them into town, where he sells them to a dealer in these commodities. Occasionally a small lot may be sent directly by parcel post or express to the drug dealer by the original collector, but the usual channel is through the country storekeepers. The daisy flowers, as received by the drug dealers, are remarkably free from other plant material, and the quantity of adhering stalk is negligible, an occasional corncob or chicken feather being practically the only extraneous material found with the flowers.

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[1] "Insect powder" consists of the powdered flower heads of any of the following species of Chrysanthemum: (1) *Chrysanthemum* (*Pyrethrum*) *cinerariæfolium* (Trev.) Bocc.; (2) *Chrysanthemum* (*Pyrethrum*) *roseum* Web and Mohr.; (3) *Chrysanthemum marshallii* Aschers (synonym, *Pyrethrum carneum* M. B.). (Insecticide Decision 1, Insecticide and Fungicide Board, U. S. Department of Agriculture, August 26, 1911.) At the present time all of the insect powder obtained in the United States is of the first-named species.

A review of the literature shows that this species of Chrysanthemum has long been recognized as an adulterant of insect powder. Beringer (*2*)[2], Schrenk (*29*), and Unger (*36*) were the first to report the use of these flowers for this purpose. Others who include daisy flowers in the list of common adulterants of insect powder are Caesar and Loretz (*4*), Huber (*17*), Verneau (*38*), Tschirch and Oesterle (*35*), Durrant (*11*), Hockauf (*16*), and Hanausek and Winton (*15*). Siedler (*31*) states that the flowers of *C. leucanthemum* have been exported from Dalmatia for several years under the name, "false insect flowers."

USES FOR CHRYSANTHEMUM LEUCANTHEMUM.

Schoepf (*28*), La Tourrette (*19*), Shecut (*30*), Rafinesque (*25*), Williams (*40*), Stearns (*32*), and Dragendorff (*9*) describe certain medicinal uses for *Chrysanthemum leucanthemum.* According to Cutler (*7*) and Shecut (*30*), the young leaves have been employed in salads. Merat and De Lens (*21*) of France and Porcher (*24*) of the United States state that no use is made of the plant in these countries. Stearns (*32*), however, states that the flowers were used in medicine by the natives of Michigan in the early fifties.

According to the United States Dispensatory (*37*), German chamomile (*Matricaria chamomilla* L.) is sometimes adulterated with the flower heads of the common daisy, and Griffith (*14*) lists it as an adulterant or substitute for chamomile (*Anthemis nobilis* L.). Through an investigation of the subject in 1918, the writers learned that oxeye daisy flowers are used to a very limited extent in some of the New England States in the preparation of a "tea" for "medicinal" purposes. The daisy flowers collected in this country, however, are used largely, if not exclusively, as an adulterant of insect powder.

INSECTICIDAL ACTION OF CHRYSANTHEMUM LEUCANTHEMUM.

Cantraine (*5*) learned in Ragusa that the Bosnians and Dalmatians used *C. leucanthemum* to destroy fleas, but fails to state what part of the plant served this purpose. It is quite probable that Cantraine mistook the flowers of *C. cinerariæfolium* for those of *C. leucanthemum* because of their similarity. Garrigues (*12*) quotes

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[2] The numbers (italic), in parentheses, refer to the bibliography, page 7.

Cantraine and an unnamed writer who states that the flowers, dried, pulverized, and used as the *Pyrethrum caucasicum*, have the power of destroying insects. An anonymous writer in the Gardeners' Chronicle (*1*) states that the Spaniards burn the centers of these flowers in order to keep away gnats.

Kalbruner (*18*), Beringer (*2*), Caesar and Loretz (*3*), Huber (*17*), and Riley (*27*) found powdered daisy flowers to be inactive as an insecticide. Scott and Abbott, of the Bureau of Entomology, United States Department of Agriculture, found powdered daisy flowers to be inactive against roaches, bedbugs, house flies, cabbage aphis, chrysanthemum aphis, nasturtium aphis, orthezia, and red spider.

The use of daisy flowers in insect powder is for no other purpose than to cheapen it. The extent to which this form of adulteration is being carried on made necessary a special study of this subject, with the view of establishing methods for its detection and quantitative estimation. Samples of the flowers of *C. leucanthemum* were collected for this purpose from various sources, mainly from the collectors of " medicinal " herbs in the mountainous regions of Virginia and North Carolina.

CHEMISTRY OF CHRYSANTHEMUM LEUCANTHEMUM.

More or less complete analyses of *C. leucanthemum* have been made by Goessmann (*13*), Millspaugh (*22*), Stone (*33*), Penny (*23*), Beringer (*2*), Thoms (*34*), and Dietze (*8*). The results obtained by them are given in Table 1.

TABLE 1.—*Analyses of Chrysanthemum leucanthemum L.*

Analyst.	Source of sample.	Part of plant.	Moisture.[1]	Nitrogen, N.[2]	Ash.	Fat (ether extract).	Crude fiber	Phosphorus pentoxid, P_2O_5.	Potassium oxid, K_2O.	Manganese, Mn.	Water extract.	Alcohol extract.	Petroleum-ether extract.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Goessmann	Mass.	Whole plant.	9.65	1.36	7.80	2.57	39.94	......	......	......	......	......	......
Millspaugh	W.Va	do	......	2.12	......	......	......	0.45	2.88	......	......	......	......
Stone	N. H.	do	77.50	1.36	8.40	2.53	28.89	......	......	......	......	......	......
Penny	Del	do	70.89	1.29	7.08	4.99	28.16	......	......	......	......	......	......
Beringer	(?)	Flowers only	......	......	9.30	2.68	......	......	......	......	13.43	9.45	3.37
Thoms	(?)	do	10.11	......	8.93	......	......	......	......	Pres.	......	......	......
Dietze	(?)	do	7.59	......	8.90	[3] 3.76 [4] 3.17	......	......	......	......	......	......	[5] 2.46 [6] 2.25

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[1] In those cases in which moisture is reported, the results for the other constituents are calculated on a moisture-free basis.
[2] Protein divided by 6.25.
[3] Ether of specific gravity 0.735 used.
[4] "Purest" petroleum ether used.
[5] Petroleum ether used.
[6] Ether of specific gravity 0.720 used.

In Table 2 are presented the results of analyses of the samples collected by the authors and obtained from drug collectors in Virginia and North Carolina during the summer of 1917. The analyses were made according to the methods of the Association of Official Agricultural Chemists.

TABLE 2.—*Analyses of oxeye daisy flowers (Chrysanthemum leucanthemum L.).*[1]

Laboratory No.	Place collected.	Date collected.	Moisture.	Nitrogen, N.	Ash.	Ash insol. in HCl.	Crude fiber.	Pentosans.	Ether extract.	Petroleum-ether extract.	Phosphorus pentoxid, P_2O_5.	Manganese, Mn.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
28242	Southwestern Virginia	July, 1917	6.03	1.81	9.60	0.66	23.17	13.29	5.16	3.66	0.85	0.0087
28243	do	do	6.95	1.80	9.20	.42	21.70	....	5.31	3.82	....	.0098
28244	do	do	5.53	1.87	9.68	.48	23.49	....	4.59	3.30	....	.0093
28245	do	do	6.78	1.91	10.12	1.20	22.03	11.97	4.87	3.46	.85	.0104
28246	do	do	6.98	1.80	9.10	.30	22.38	....	5.47	3.63	....	.0096
28247	do	do	6.25	1.86	9.06	.38	23.37	....	4.93	3.71	....	.0082
28248	do	do	7.15	1.95	9.60	.90	22.56	....	4.90	3.32	....	.0111
28249	do	do	6.45	1.93	9.90	.60	22.40	....	5.53	3.58	....	.0101
28250	do	do	7.18	1.94	9.44	.78	22.69	12.41	4.91	3.09	.86	.0090
28251	do	do	6.60	1.84	9.86	.88	24.09	....	5.53	3.85	....	.0083
28252	do	do	6.88	1.90	9.46	.84	22.98	....	4.96	3.66	....	.0096
28253	do	do	4.83	1.83	9.54	.44	22.47	....	4.80	3.62	....	.0086
28256	Western North Carolina	June, 1917	4.30	1.93	9.36	.58	22.63	12.95	4.02	3.18	.69	.0113
28257	do	July, 1917	4.58	1.79	12.49	2.84	22.45	11.63	4.83	3.34	.81	.0079
28258	do	Aug., 1917	5.18	1.82	11.70	2.52	24.23	12.10	5.52	3.54	.88	.0072
28396	Buncombe Co., N. C.	do	8.25	2.07	10.74	1.85	22.75	11.83	5.11	3.51	.93	.0110
28397	do	do	8.09	1.66	9.90	1.26	21.04	11.99	5.33	3.50	.98	.0083
28398	Yancey Co., N. C.	July, 1917	7.62	1.77	12.68	3.04	22.63	11.80	5.34	3.80	.81	.0102
28399	do	do	7.92	1.62	9.38	.46	21.93	12.67	6.27	4.46	.88	.0083
14933	Not known	....	......	1.82	10.02	.92	20.14	14.34	3.18	....	.68	......
23020	Markham, Va.	July, 1915	......	2.23	10.45	.15	....	....	....	....	....	......
	Minimum	....	4.30	1.62	9.06	.15	20.14	11.63	3.18	3.09	.68	.0072
	Maximum	....	8.25	2.23	12.68	3.04	24.23	14.34	6.27	4.46	.98	.0113
	Average	....	6.50	1.86	10.06	1.02	22.56	12.45	5.03	3.58	.84	.0093

[1] J. J. T. Graham, assistant chemist, Insecticide and Fungicide Laboratory, assisted in making the analyses reported in this table.

TABLE 3.—*Comparison of average analyses of C. cinerariæfolium and C. leucanthemum L.*[1]

Sample.	Moisture.[2]	Nitrogen, N.[2]	Ash.[2]	Ash insol. in HCl.[2]	Crude fiber.[2]
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
C. cinerariæfolium:					
Closed flowers	....	1.784 (103)	7.20 (103)	0.49 (103)	22.09 (27)
Open flowers	6.69 (17)	1.267 (104)	6.09 (104)	.26 (104)	31.02 (28)
Stems	....	.765 (73)	4.90 (38)	.50 (38)	40.66 (27)
C. leucanthemum:					
Flowers	6.50 (19)	1.86 (21)	10.06 (21)	1.02 (21)	22.56 (20)

Sample.	Pentosans.[2]	Ether extract.[2]	Petroleum-ether extract.[2]	Phosphorus pentoxid, P_2O_5.[2]	Manganese, Mn.[2]
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
C. cinerariæfolium:					
Closed flowers	16.66 (5)	6.87 (6)	4.11 (5)	0.691 (34)	[3] 0.0120 (22)
Open flowers	21.11 (5)	5.81 (8)	4.06 (8)	.532 (94)	[3] .0076 (13)
Stems	18.21 (5)	3.22 (7)	1.97 (7)	.234 (38)	[3] .0100 (22)
C. leucanthemum:					
Flowers	12.45 (11)	5.03 (20)	3.58 (19)	.84 (11)	.0093 (19)

[1] These results, except those for manganese, are taken from U. S. Department Agriculture Bulletin 824, "Insect Powder," by McDonnell, Roark, and Keenan, issued in 1920.

[2] The numbers in parentheses indicate the number of samples upon which the determination in question was made.

[3] "Manganese in Insect Flowers and Insect Flower Stems," J. Agr. Research (1917) *11*: 81.

Table 3 gives a comparison of analyses of the different commercial grades of insect flowers ("open" and "closed") and insect flower stems with those of the flowers of *C. leucanthemum.* The averages of all determinations are compared for each constituent.

The results in Table 3 show that the greatest differences in the chemical composition are in the phosphorus, ash, and pentosans, which are higher in the flowers of *C. leucanthemum* than in those of *C. cinerariæfolium.* It is evident, however, that a chemical analysis alone is insufficient to show adulteration of insect powder with powdered daisy flowers. Such adulteration can be definitely determined only by microscopic examination.

MORPHOLOGY OF CHRYSANTHEMUM LEUCANTHEMUM.

The daisy plant is a typical Composite. It is a perennial, with nearly smooth stem, growing to a height of from 1 to 3 feet, and sparingly branched. The leaves are coarsely cut, the uppermost leaves being smaller than the lower ones and nearly entire. The flower heads consist of white ray flowers and yellow disc flowers. The involucral bracts are lanceolate, nearly smooth, with a narrow, chestnut-brown margin. The fruit, when mature, consists of very small achenes, with a black background and conspicuous white ribs running lengthwise of the fruit. There is usually a small tubercle or knoblike projection on the broad end, apparently the remains of the flowers (Pl. I, Fig. 2).

Beringer (*2*) and Vogtherr (*39*) go into detail in a morphological description of field daisy flowers.

Field daisy flowers occurring in insect flowers are much more easily detected than when in powdered form. The most positive character that can be relied upon for their detection is the fruit. Even in an immature condition, the fruit of the daisy does not resemble that of *Chrysanthemum cinerariæfolium.* The following compilation is given to serve as an aid in distinguishing between the fruits of *C. cinerariæfolium* and those of *C. leucanthemum* (Pl. I, Figs. 1 and 2).

Dalmatian flowers.—Achenes 5-ribbed; possess small-toothed crown; golden yellow in color; ray floret achenes more curved or arched than the disc floret achenes (Pl. I, Fig. 1).

Daisy flowers.—Achenes usually 10-ribbed; ribs very prominent, white, alternating with black stripes; tubercle or knoblike projections on broad end of achene; achene much smaller than that of the Dalmatian flower (Pl. I, Fig. 2).

HISTOLOGY.

Schrenk (*29*) claims to have found a positively characteristic structure of daisy powder in the small, several-celled hairs which he detected in considerable numbers on the apparently glabrous scales (Pl. II, fig. 4). Durrant (*10*) found difficulty in detecting daisy in genuine insect powder, and Beringer (*2*) could detect no difference microscopically between the two powders.

However easily the hairs Schrenk has referred to may be detected on the unground involucral scales, their presence is very difficult to establish when the scales are powdered. Apparently the hairs are very fragile and are readily broken up in the process of grinding.

The achenes of *Chrysanthemum cinerariæfolium* and *Chrysanthemum leucanthemum* are strikingly different in the powdered form. The achene tissues of the Dalmatian flowers (*C. cinerariæfolium*) are characterized by numerous crystals. On the other hand, the achene tissues of the daisy flowers (*C. leucanthemum*) exhibit no such crystals, but contain a notable quantity of a brownish-red material, the location of which is readily demonstrated in a cross section of the fruit. In a cross section of the achene, crescent-shaped structures, corresponding to each of the 10 ribs, stand out very distinctly (Fig. 1).

When the daisy flower heads are powdered, this brownish-red material contained in the crescent-shaped structures breaks up into irregular, angular fragments, sometimes attached to the surrounding tissues and sometimes separated from them. These fragments have a deep, brownish-red color and are clearly seen when the powder is warmed in a solution of chloral hydrate in water (about 1:1).

Another diagnostic element is a portion of the tissue from the white ribs of the daisy achene. The outer portion of the rib consists, in radial section, of what are apparently epidermal cells. They appear to have a palisadelike arrangement, consisting of narrow, thick-walled cells packed very closely together (Pl. II, Fig. 2). This tissue, which invariably occurs in the daisy powder in the form of radial sections, serves as another means for detecting its presence in genuine insect powder.

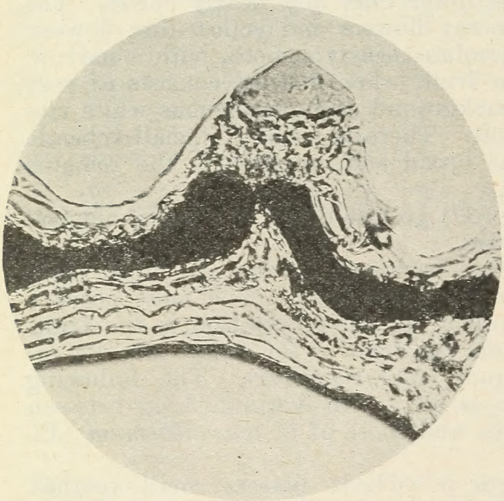

FIG. 1.—Cross-section of daisy achene (illustrating crescent-shaped structures.)

Experience gained in the comparative study of a large number of samples ground from insect flowers and from daisy flowers has emphasized the need for caution in placing reliance upon any histological characters in the daisy flowers other than those of the achene. Other characters, with the exception of the T-shaped hairs of the Dalmatian flowers (Pl. II, Fig. 3) and the crystal-bearing stone cells of the achene, are too nearly like similar characters in insect flowers. While these hairs and crystal-bearing stone cells of the achene would furnish a means of identifying Dalmatian flowers in a mixture with other materials, they apparently offer no means of disclosing the presence of the daisy flowers when mixed with Dalmatian flowers. Thus the presence of this brownish-red material (Pl. I, Fig. 4) and the palisadelike epidermal cells (Pl. II, Fig. 2) furnish a reliable means of detecting even small quantities of daisy flowers in a mixture.

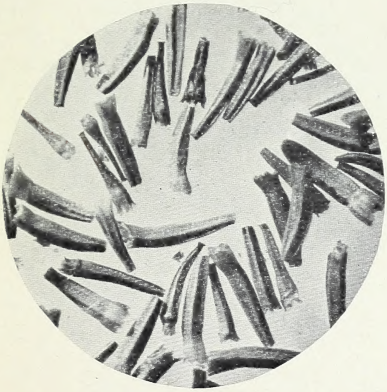

FIG. 1.—Achenes, Dalmatian flowers (×3).

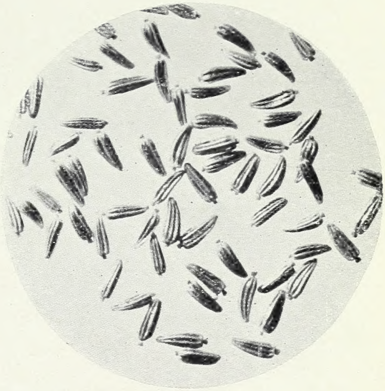

FIG. 2.—Achenes, daisy flowers (×3).

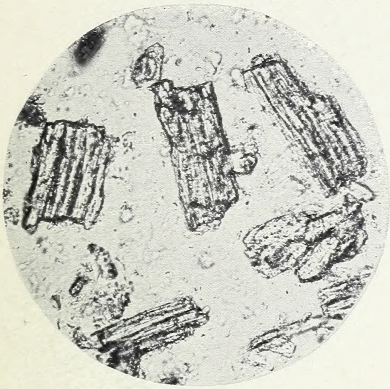

FIG. 3.—Achene tissue, Dalmatian flowers (×130).

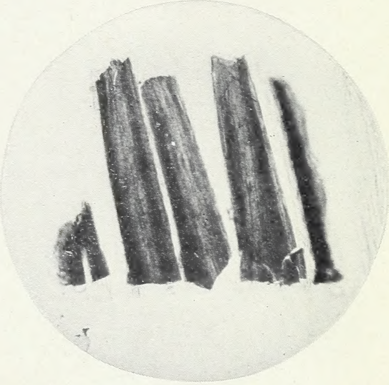

FIG. 4.—Achene tissue, daisy flowers (×240).

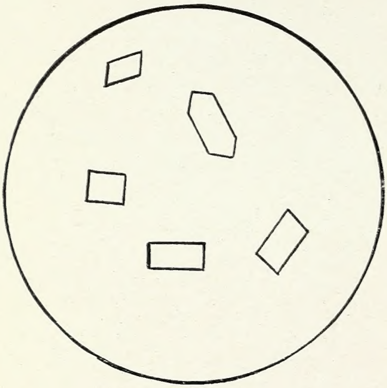

FIG. 1.—Crystals from achenes, Dalmatian flowers (magnified).

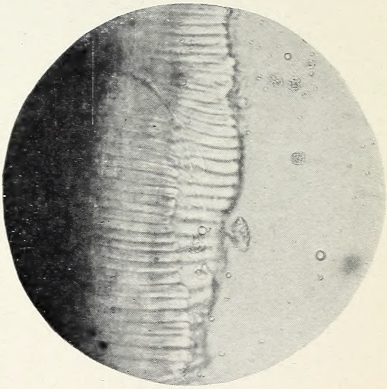

FIG. 2.—Achene tissue, daisy flowers (×180).

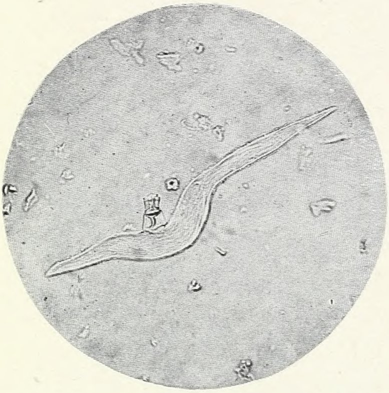

FIG. 3.—Stalked hair, Dalmatian flowers (magnified).

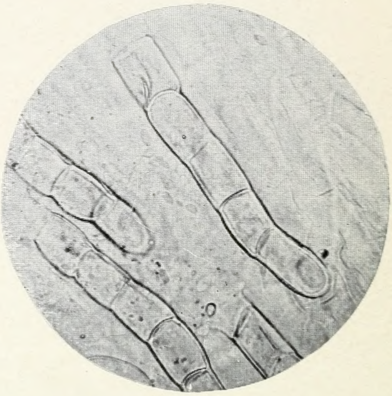

FIG. 4—Hairs, daisy flowers (×350)

No attempt has been made to describe the other parts of the daisy flower in detail, the scope of this bulletin being limited to those differentiating tissue elements which might be detected readily in an insect powder adulterated with powdered daisy flowers. A brief description of the diagnostic tissues of the achenes of the Dalmatian flower (*C. cinerariæfolium*) and of the daisy flower (*C. leucanthemum*) follows:

Dalmatian flower achene.—Characterized in the powder by rectangular patches of hard sclerenchyma tissues, strongly lignified and possessing numerous clinorhombic crystals which exhibit a great variety of colors with crossed nicols. In older flowers (open flowers) isolated stone cells are very common (Pl. I, Fig. 3; Pl. II, Fig. 1).

Daisy flower achene.—Characterized in the powder by irregular dark-red fragments of variable size, which are very evident when the powder, after being cleared in chloral hydrate solution (about 1:1), is examined under the microscope; also by closely packed palisadelike tissue with thick walls and narrow lumina, usually present in radial section in the powder (Pl. I, Fig. 4; Pl. II, Fig. 2).

SUMMARY.

While there are certain differences in the chemical composition of *Chrysanthemum cinerariæfolium* and *Chrysanthemum leucanthemum*, a chemical analysis is insufficient to show adulteration of insect powder with daisy flowers.

Adulteration of insect powder with powdered daisy flowers can be definitely determined by microscopic examination. Powdered daisy flowers are distinguished by (*a*) irregular dark-red fragments of the achene, and (*b*) palisadelike cells comprising the costal tissue of the achene.

LITERATURE CITED.

(1) Anonymous.
Insecticides. *In* Pharm. J. (1871), *31* (3d ser., *2*): 530.

(2) Beringer, G. M.
The Hungarian daisy as an adulterant of insect powder. *In* Am. J. Pharm. (1889), *61* (4th ser., *19*): 1–4.

(3) Caesar and Loretz.
Chrysanthemum leucanthemum. *In* Pharm. Ztg. (1889), *34*: 306–7.

(4) ———
Insektenpulver. *In* Pharm. Ztg. (1898), *43*: 325.

(5) Cantraine, —.
Note sur le Chrysanthemum Leucanthemum, considéré comme spécifique contre les puces. *In* Bul. acad. roy. sci. Belg. (1841), *8* (pt. 2): 234.

(6) Collin, Eugène.
A study of the anatomy of insect flowers. *In* Pharm. J. (1901), *67* (4th ser., *13*): 474–6, 503–6, 601–5.

(7) Cutler, Manasseh.
An account of some of the vegetable productions, naturally growing in this part of America. Bull. 7, Reproduction Series 4, Lloyd Library of Botany, Pharmacy, and Materia Medica, p. 483. Cincinnati, 1903.

(8) Dietze, F.
Zur Werthbestimmung des Insektenpulvers. Pharm. Ztg. (1899), *44*: 196.

(9) Dragendorff, G.
Die Heilpflanzen der Verschiedenen Völker und Zeiten, p. 675. Stuttgart, 1898.

(10) Durrant, George R.
Insect powders of commerce. *In* Am. J. Pharm. (1897), *69*: 359–366.

(11) ———
Insect powders of commerce. *In* Pharm. J. (1897), *58* (4th ser., *4*): 506.

(12) Garrigues, Samuel S.
On insect powder. *In* Proc. Am. Pharm. Assoc. (1871), *19*: 506.

(13) Goessmann, C. A.
Dalmatian insect powder: *C. leucanthemum. In* 9th Ann. Rept. Board of Control, Mass. Agr. Exp. Sta., 1891, p. 317. Boston, 1892.

(14) Griffith, R. E.
Medical botany, p. 287. Philadelphia, 1847.

(15) Hanausek, T. F., and Winton, A. L.
The microscopy of technical products, 1st ed., p. 323. New York, 1907.

(16) Hockauf, —.
Z. oesterr. Apoth.-Ver., p. 81, 1903. *Abstract in* Jahresb. Pharm. (1903), *38*: 39.

(17) Huber, E. J.
Adulteration of insect powder. *In* Bull. Pharm. (1899), *13*: 253.

(18) Kalbruner, Hermann.
Ueber die insektenvertilgende Wirkung einiger Pyrethrumarten. *In* Z. oesterr. Apoth.-Ver. (1874), *12*: 542–3.

(19) La Tourrette, —.
Démonstrations élémentaires de botanique, vol. 3, p. 65. Lyon, 1796.

(20) Markoe, George F. H.
Plants useful as insecticides. *In* Proc. Am. Pharm. Assoc. (1871), *19*: 115–6.

(21) Merat, F. J., and De Lens, A. J.
Dictionnaire universel de matière médicale, et de thérapeutique générale, vol. 1, p. 441. Bruxelles, 1837.

(22) Millspaugh, C. F.
Your weeds and your neighbors: Part I, weeds as fertilizers. W. Va. Agr. Exp. Sta. Bull. 19 (1891), p. 123.

(23) Penny, C. L.
C. leucanthemum and *Erigeron annuum. In* Rept. Chemist, 8th Ann. Rept. Del. College Agr. Exp. Sta., 1895–6, p. 159.

(24) Porcher, Francis Peyre.
Medicinal plants of South Carolina. *In* Trans. Am. Med. Assoc. (1849), *2*: 797.

(25) Rafinesque, C. S.
Medical flora; or manual of the medical botany of the United States of North America, vol. 2, p. 208. Philadelphia, 1830.

(26) Rehmann, —.
Nouveau J. med. chir. pharm. (1819), *5*: 209.

(27) Riley, C. V.
Pyrethrum. *In* 4th Rept. U. S. Entomological Commission (1885), p. 180.

(28) Schoepf, Davidis.
Materia Medica Americana Potissimum Regni Vegetabilis. Erlangae, 1787. *Reprint in* Bull. 6, Reproduction Series 3, Lloyd Library of Botany, Pharmacy and Materia Medica, p. 125. Cincinnati, 1903.

(29) Schrenk, Joseph.
Pharmacognostical notes: No. 6. Insect flowers. *In* Am. Druggist (1889), *18*: 42.

(30) Shecut, John L. E. W.
Flora Carolinæensis, vol. 1, p. 394. Charleston, 1806.

(31) Siedler, P., and Jüttner, E.
Über Produktion, Handel, Verfälschungen und Prüfung des Dalmatiner und Montenegriner Insektenpulvers. *In* Ber. pharm. Ges. (1912), *22*: 408.

(32) Stearns, Frederick.
The medicinal plants of Michigan: *Chrysanthemum Leucanthemum; Pyrethrum parthenium. In* Proc. Am. Pharm. Assoc. (1858), *7*: 253, 276.

(33) Stone, E. P.
Composition of oxeye daisy. *In* 5th Ann. Rept., N. H. Agr. Exp. Sta., 1892–3, pt. 2, p. 139.

(34) Thoms, H.
Untersuchung von Insectenpulver. *In* Chem. Ztg. (1890), *14*: 1284.

(35) Tschirch, Alexander, and Oesterle, O.
Anatomischer Atlas der Pharmakognosie und Nahrungsmittelkunde. Flores pyrethri, pp. 171–174, table 40. Leipzig, 1900.

(36) Unger, H.
Adulterated insect powder. *In* Chemist Druggist (1890), *36*: 347; Yearbook Pharmacy, 1890, p. 173.

(37) United States Dispensatory, 20th ed. (1918), p. 689.

(38) Verneau, Victor.
Étude sur les pyrèthres. Thèse presentée et publiquement soutenue à l'École Supérieure de Pharmacie de Montpellier, April 9, 1892, p. 54, 1 plate.

(39) Vogtherr, M.
Zur Diagnose offizineller Kompositenblüten und ihrer Verwechselungen: *Chrysanthemum*. *In* Ber. pharm. Ges. (1897), 7: 48–50.

(40) Williams, Stephen W.
Report on the indigenous medical botany of Massachusetts. *In* Trans. Am. Med. Assoc. (1849), *2*: 895.

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